How long will the cold last?

Description

Will the current cold spell last or will we see a return to the wet and windy weather we experienced through the Christmas and new year period?

After the unsettled Christmas and New Year period we are now seeing an abrupt change to much colder weather with temperatures below average for January for much of the UK and an increasing chance of cold weather impacts. Frost is likely overnight and, given the ground moisture, calm conditions, and long nights, there is also a risk of fog and icy conditions.

As always, there is a great deal of speculation about how long the cold spell might last and how cold it might get. To answer these questions, we need to look beyond the UK. When looking at forecasts beyond five days into the future, global weather can have significant impacts on the UK weather and can drive persistent weather patterns here.

World weather is interconnected, and longer-range forecasts rely on slowly varying aspects of the global weather and climate system, known as climate drivers. There are large scale global drivers which we know have influences on UK weather at this time of year – so what are these doing at the moment?

A strong El Niño, the naturally occurring warming of the Pacific Ocean, is now fully developed. This increases the likelihood that the second half of winter and early spring will be colder and drier than the first half.

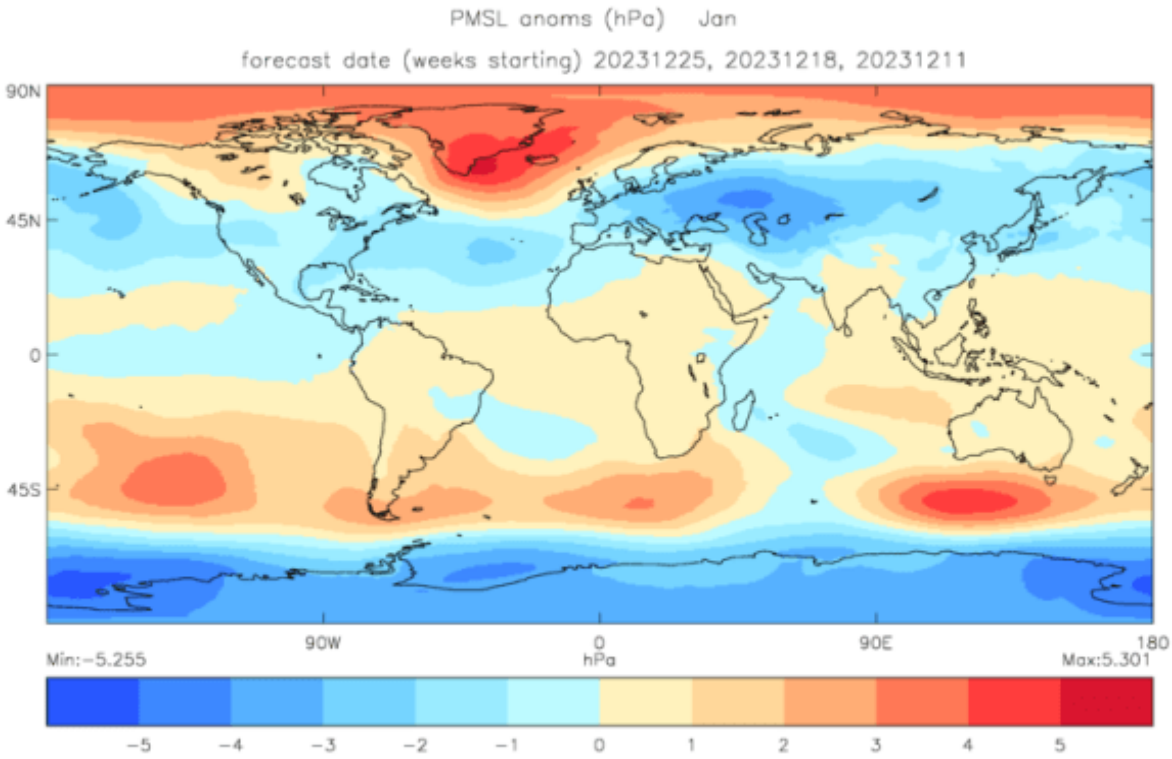
There is also a Sudden Stratospheric Warming (SSW) underway, but this is currently a minor event as the stratospheric winds are only expected to weaken and are not expected to fully reverse. Even so, this could still impact weather at the earth's surface as the Stratospheric Polar Vortex is very weak compared to its usual strong westerly state and it is also still possible that a major SSW could occur later this winter.

A SSW can result in a 'blocked' weather pattern for the UK, leading to a reduction in Atlantic low pressure systems crossing the UK and therefore, increasing the chance of cold, dry weather here and mild, wet and windy conditions for southern Europe. However, the impacts of an SSW on UK weather can also be benign, it does not always lead to cold weather.

Professor Adam Scaife, Head of Long-Range Forecasting at the Met Office, said: "The current weakening of the stratospheric polar vortex tallies with our forecasts for more blocked, colder and drier conditions in the coming month."

Another factor influencing the UK this winter is the Quasi-Biennial Oscillation (QBO), a regular variation of the winds that blow high above the equator. The QBO is currently in an easterly phase, increasing the likelihood of cold northerly or easterly winds from the Arctic and continental Europe.

Meanwhile the North Atlantic Oscillation, variations in the large-scale surface pressure gradient in the North Atlantic region, is moving into a negative phase. This reduces the risk of storms and also increases the risk of colder weather. The current pattern of sea surface temperatures in the North Atlantic Ocean is yet another driver which, at this time, is conducive to a reduction in the chance of storm bearing westerly winds.



This is a pressure forecast map. It shows the higher than normal pressure to the north and west of the UK on average. This indicates increased chances of cold north-easterly winds during the coming month.

All these effects are happening on a background of warming UK winters, consistent with wider global warming trends.

Therefore, taking all these ‘global drivers’ into consideration, our long-range forecast systems suggest that there is an increased chance of colder than average conditions compared to normal as we head through the rest of this winter with an increasing risk of cold weather impacts such as snow and ice.

It is important to remember that the science of longer-range and seasonal outlooks is at the cutting edge of meteorology and comes with inherent uncertainties. While the Met Office is one of the leaders in scientific research in the area, even with ‘perfect’ prediction systems and ‘perfect’ meteorological observations, the fundamental chaotic nature of the atmosphere will still limit the skill of these predictions.

Despite any speculation you may read elsewhere the science at this time simply does not allow for specific detail on the amount of rain or snow over the coming months or exactly when severe weather may occur. However, long-range forecasts can provide useful information on the likelihood of possible conditions averaged over the UK for the season as a whole.

You can check the long range forecast and daily weather forecast on our website. You can also follow us on Twitter and Facebook, as well as on our mobile app which is available for iPhone from the App store and for Android from the Google Play store. Our three-month outlooks are updated each month. Keep track of current weather warnings on the weather warning page.

Date Created
January 2024

Understanding weather and climate extremes

Description

Climate change is, as expected, leading to an increase in extreme weather, including in the UK. The latest State of the UK Climate report, published in July 2023 and providing a look back at 2022, highlighted a year of extremes. 2022 was shown to be the warmest year in the UK series from 1884, 0.9 °C above the 1991–2020 average, and included the first time 40 °C was recorded in the UK. Earlier this month, we also announced that 2023 was provisionally the second warmest year on record for the UK. Records also show that the UK is getting wetter, and heavy rainfall exceeding 50mm has become more frequent in the autumn. A warmer, moister atmosphere increases the capacity for deluges of rain, which can result in serious flooding.

In recognition of this increase in extremes and a need to continue to improve predictions of extreme weather and to assess its impacts, last year we formed a team of experts from across the Met Office to focus on the links between climate change and weather extremes. Ultimately this team seeks to help the public, industry, business, and local and national government deal with extreme weather and remain safe and resilient in a changing climate.

Trans-disciplinary expertise

As the UK's national weather service, forecasting the weather is the Met Office's core business, but combining this with world-leading climate science from the Met Office Hadley Centre means that we can provide seamless scientific expertise across weather and climate timescales.

The new team is co-ordinating and developing a trans-disciplinary approach across the Met Office and our partners, with the team itself bringing together different areas of expertise. Headed up by Climate Extremes Principal Fellow and Chief Meteorologist Paul Davies, the team also includes experts in climate monitoring, weather and climate extremes and the Met Office's first Socio-Meteorologist.

Providing context for extreme weather

A key role of the new team is to help provide the context around extreme weather. Increasingly, the public, media, industry and government are asking questions about whether particular weather trends or extreme weather events are due to climate change or part of the natural variability of UK weather. One of the key initial tasks of the team last year was to collate the latest science on different weather extremes for the UK, helping provide colleagues with the right information they needed to answer some of these questions. We'll be exploring some of the top-level findings of this work in another blog post later this month.

In the midst of a severe weather event, we often get asked whether this has been caused by climate change. Our team of experts has been building on the high levels of expertise in attribution science from within the Met Office, to help provide quicker answers to these questions without moving away

from the scientific rigour of attribution studies. You can learn more about attributing extreme weather to climate change on our website.

Understanding impacts

As well as bringing together the science of weather and climate, understanding the impacts of extreme weather and climate change is critical to improving resilience. Through a process of reviewing extreme events and considering the likelihood of unprecedented extremes, Paul Davies' team is helping to bring together information that will assist all parts of society in preparing for and adapting to extreme weather. We know that extreme weather due to our changing climate is already happening and will continue to happen in the years to come, so building resilience is critical.

Reducing the impact of climate change

Building resilience is one part of the puzzle in how we can tackle climate change, but adaptation needs to go hand in hand with mitigation. Deep and rapid cuts to greenhouse gas emissions will help reduce the likelihood of the most severe impacts of climate change.

Action is required across all levels of society – to find out more about how you can make a difference, take a look at our Get Climate Ready webpages.

Follow the #GetClimateReady hashtag on X (formerly Twitter) to learn more about weather and climate extremes this month.

Date Created
January 2024

The influence of climate change on severe weather

Description

As shared in our recent blog post on understanding weather and climate extremes, we are seeing an increase of extreme weather around the world including in the UK. Since the industrial revolution, the average temperature of the planet has risen by around 1.26 °C (based on the suggested approach of Met Office researchers). This is a rapid change in terms of our global climate system and has already led to the changes in the extreme weather we are experiencing.

The Met Office's dedicated team looking at weather and climate extremes has collated the latest published academic literature on severe weather in the UK in the context of our changing climate. In this blog post, Climate Extremes Principal Fellow and Chief Meteorologist Paul Davies shares some of the findings from that work.

Extreme heat

The frequency and intensity of heatwaves have increased worldwide. A number of major heatwaves in the UK have occurred in the past 5 years (2018, 2019, 2021 and 2022), each seeing new temperature records set. Notably the England record has been set three times over. Numerous climate attribution studies have shown that human influences have increased the chances of occurrence of specific

extreme heat events such as the summer of 2018 and July 2022. Almost all studies on extreme heat events indicate human influence.

Looking ahead, the headline findings from UK Climate Projections (UKCP) indicate that on average, summers will become hotter. Met Office UKCP Local projections indicate that hot spells will become more frequent in our future climate, particularly over the south-east of the UK, with temperatures projected to rise in all seasons.

Heavy rainfall

In the recent climate, it has generally become wetter, particularly during winter. The winters of 2014, 2016 and 2020 are all in the top five wettest (the other winters being 1995 and 1990). One reason for this is the large annual, seasonal and decadal variability in rainfall, but in winter the emerging climate change signal resulting from increased atmospheric moisture is an important secondary factor. Rainfall totals on the wettest days have increased, this is more strongly linked to climate change.

In the future, climate projections for the UK indicate there being a greater risk of heavy precipitation and prolonged events in the future, particularly during winter.

As the atmosphere warms due to human induced climate change it can hold more moisture, at a rate of around 7% more moisture for every degree of warming. This means that when it does rain it can be more intense. On a simple level, this explains why in many regions of the world projections show an increase in precipitation as a consequence of human induced climate change.

Intense rainfall from thunderstorms

In the recent climate, trends in short rainfall events lasting less that one day are difficult to detect, due to historically sparse sub-daily observations and natural year-to-year and decade-to-decade variability. Extreme precipitation associated with thunderstorms, is, however, projected to intensify with climate change.

In the future, rainfall events exceeding 20mm per hour, which can cause flash flooding, are expected to be four times as frequent by the 2070s compared to the 1980s, under a high emissions scenario i.e., if greenhouse gas emissions continue unabated at a high level. Changes are not projected to happen gradually, but instead extreme years with lots of events could tend to cluster. When and by how much these changes are projected to occur varies in different regions of the UK.

Windstorms

In the recent climate, there is no evidence of positive or negative trends in windstorm number or intensity over the UK. Trends in windstorm numbers are difficult to detect, due to how these naturally vary year-to-year and decade-to-decade. As well as wind damage, windstorms can cause impacts from storm surges and high waves in coastal areas. These are expected to worsen as sea level rises.

Most climate projections indicate that winter windstorms will increase slightly in number and intensity over the UK i.e., more winter storms, including disproportionately more severe storms. However, there

is medium rather than high confidence in this projection because some climate models indicate differently.

Drought

Whilst there have been observed changes in the drivers of drought in the UK, there is much less evidence of trends in many drought metrics at present. However, the impact of extreme hot periods in summer has been noticeable in recent years (2018 and 2022) and shows the impact rising temperatures can have on water supply and demand.

Currently, there are no UK climate attribution studies available that clearly link human induced climate change with an altered risk of drought events. However, attribution studies have been carried out for extreme temperature events, which can lead to increases in evaporation, drier soil and considerable impacts on water supplies.

Most studies into our future climate point towards general increases in frequency and length of meteorological drought for the UK. This general rainfall deficit can exacerbate other forms of drought such as hydrological drought or agricultural drought, but these other forms of drought can have other drivers such as groundwater storage, drier soil and low river flows.

Extreme cold and snow

Despite the warming climate, extreme cold events still occur in the UK due to natural variability. The decrease in the frequency, duration, and intensity of these events over recent decades is clearly linked to the observed warming of the planet and can be attributed to human activity. For example, attribution studies have found that the unusually cold European winter of 2009/2010, UK cold snap in March 2018 (which included the event widely known as the Beast from the East) and the cold UK spring of 2013 would be much more likely without human influence on the climate.

The number of air and ground frost days in recent years has also decreased, with 4% fewer days of air frost in the most recent decade (2013-2022) than the 1991–2020 average, and 15% fewer than the 1961–1990 average. 2013-2022 also had 7% fewer days of ground frost than the 1991-2020 average and 24% fewer than the 1961-1990 average.

Future UK winter climate will still be variable year to year, so severely cold winters are still likely to occur – just less often – so it is important to remain resilient to severe winters when they do occur. Snow in the UK is very conditional on the setup of the weather; it is not just low temperatures that lead to snow. Overall, projections show that the frequency of snow events will decrease in the UK in future. There is less certainty about the intensity of future snow events due to more complex atmospheric interactions.

Tackling climate change

Mitigating against a changing climate by reducing greenhouse gas emissions is critical to limiting warming which would help us avoid the worst impacts of climate change. We also need to adapt to the climate changes we are already seeing and the changes that are expected in the coming decades to

make sure we avoid the most significant impacts.

Action is required across all levels of society – to find out more about how you can make a difference, take a look at our Get Climate Ready webpages.

Follow the #GetClimateReady hashtag on X (formerly Twitter) to learn more about weather and climate extremes this month.

Date Created
January 2024

Why have there been so many storms in the UK this year?

Description

Storm name number ten was given when Jocelyn was named hot on the heels of Isha in what has felt like an unusually stormy autumn and winter for the UK. But why have there been so many named storms, and are there underlying factors at play?

A stormy season so far

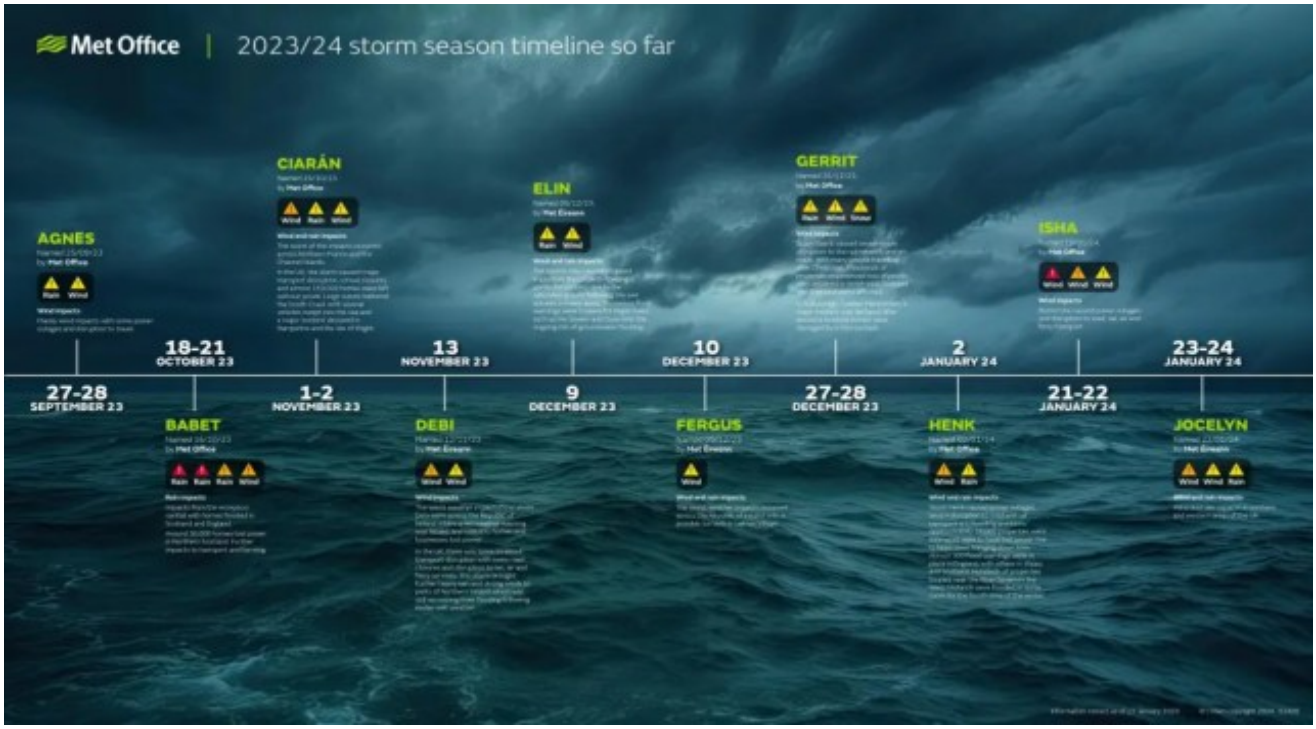
Storm Jocelyn is the tenth storm named since 1 September 2023 by the Met Office's storm naming group, which includes Met Eireann and KNMI.

The storm name season runs from 1 September to August the following year, with a new alphabetised list of names released at the start of September each year.

Since storm naming was introduced in 2015 to improve the communication of severe weather events, the furthest through the list the group has got is to Storm Katie, which impacted the UK in March 2016.

2023/24's storm naming season is now just one name away from equalling 2015/16's number of named storms, with over seven months still to go until the list is reset again.

What's behind the storms this year?



Storms are named when they're likely to cause 'medium' or 'high' impacts in Ireland, the UK or the Netherlands. They're named to raise awareness of severe weather and help people to prepare themselves so that impacts can be minimised.

To look at why the last few months have had a stormy theme, we need to look at one of the drivers of the UK weather; the jet stream.

Met Office Meteorologist and Presenter Annie Shuttleworth explained: "While we have had some drier and calmer interludes, the stormy nature of the UK's autumn and winter so far is chiefly dictated by the position and strength of the jet stream, which is a column of air high up in the atmosphere.

"The jet stream greatly influences the weather we experience in the UK and during recent months this has largely been directed towards the UK and Ireland, helping to deepen low pressure systems. These systems have been directed towards the UK and have eventually become named storms due to the strong winds and heavy rain they bring."

More recently, a pool of very cold air has sunk southwards across North America. The temperature contrast here has intensified the jet stream influencing the development of Storms Isha and Jocelyn.

What's the trend in named storms?

As storms have only been named by the Met Office since 2015, using the storm name list to assess the impact of climate change isn't statistically robust because the time period is far too short. Climate scientists typically use long-running datasets that compare decades and centuries to assess the impact of human emissions on long-term weather and climate trends.

In addition, storms are named by meteorological organisations subjectively based on their likely impacts, so it's not an objective observation-based dataset in terms of measuring the effects of climate change.

One reason people might perceive there to be more storms could be the increase in media and social media coverage when impactful weather is around compared to historical weather events.

However, the Met Office's long-term climate statistics do give a view of impactful weather in the UK in previous decades.

Climate change and windstorms

If you ignore the introduction of named storms in 2015 and look at the longer term Met Office UK climate statistics, it remains hard to detect trends in the number and severity of wind events in the UK.

Dr. Amy Doherty is Science Manager of the National Climate Information Centre at the Met Office. She explained: "The UK has a history of impactful storms stretching back hundreds of years, long before the introduction of named storms in 2015.

"One thing that is clear from observations is that there's big variability year-to-year in the number and

intensity of storms that impact the UK. This large variability is related to the UK's location at the edge of continental Europe and relatively small geographic size, so small changes in the position of the jet stream – which puts us in the path of low-pressure systems – can make a profound difference in the weather we receive.

"This large variability means that we have to be particularly cautious when analysing the data. In our observational records, it's hard to detect any trend one way or the other in terms of number and intensity of low-pressure systems that cross the UK. While our climate overall is getting wetter, there are no compelling trends in increasing storminess in recent decades. Recent stormy seasons – such as that of 2013-2014, before the storm naming system was introduced, clearly illustrate the fundamental problem with drawing conclusions from a simple count of the number of named storms."

Most climate projections indicate that winter windstorms will increase slightly in number and intensity over the UK as a result of climate change. However, there is medium rather than high confidence in this projection because some climate models indicate differently. Year-to-year variability in storm frequency and intensity will also continue to be a major factor in the future climate. We can be confident that the coastal impacts of windstorms, from storm surges and high waves, will worsen as the sea level rises.

More storms to come this year?

After Storm Jocelyn this week, the UK will continue to see spells of wet and windy weather, especially in northern and western areas. Long range models suggest that late January and early February weather could see some drier interludes further south, while wet and windy weather remains possible in the north and west.

In terms of what this means for named storms, it's too early to pick out when the next one might be, but there remains a chance of further impactful weather as we move through meteorological winter and into spring.

Find full information on storm name seasons from the Met Office since their creation in 2015 at the UK Storm Centre.

Date Created
January 2024

Is the UK winter going as forecast?

Description

There has been much coverage of the weather in recent weeks with what has so far felt like an unusually stormy autumn and winter, followed by a spell of extremely cold weather with impacts from snow and ice for many, and then on Sunday (28/01/24) a new provisional maximum temperature record for the UK for January was recorded in northwest Scotland.

To understand what has been happening over the last few months and what we might expect for the coming months, we need to look at the weather outside the UK. Global weather is interconnected and large-scale global weather and climate systems, known as climate drivers, can have major impacts on the UK at this time of year. So, what are these drivers and what are they doing at the moment?

Climate Drivers

El Niño, the naturally occurring warming of the Pacific Ocean, releases heat into the atmosphere, creating warmer and wetter air which can trigger extreme weather around the globe, resulting in impacts such as the ongoing drought in the Amazon.

As we are all aware, so far this winter, the UK, has had a wet and stormy December followed by a colder spell in January. This type of weather is consistent with what we would expect during an El Niño winter. Although we are now in a milder interlude with westerly and southerly winds, the long-range outlook still contains a good chance of a return to colder conditions.

Earlier this month the Met Office announced that globally, 2023 was the warmest year on record (data back to 1850), and it was the tenth successive year that has equalled or exceeded 1.0 °C above the pre-industrial period (1850-1900). Professor Adam Scaife, Principal Fellow and Head of Monthly to Decadal Prediction at the Met Office, said: “The above average temperatures have been driven largely by climate change but are topped up by El Niño. During an El Niño event, winds in the eastern Pacific weaken, keeping warm waters closer to the surface releasing more heat into the atmosphere and raising global temperature.

“The ongoing Amazon drought and wet conditions in parts of Northern Europe in December are also consistent with El Niño.”

Although El Niño has likely peaked in the tropics, its impacts are still being felt around the globe and Professor Adam Scaife, added: “The phenomenon could well lead to unprecedented global temperatures this year, with 2024 being the hottest year on record globally, potentially pushing the world temporarily past the key 1.5C warming milestone.”

El Niño is not the only factor driving our weather patterns. Other drivers influencing the UK this winter include the Quasi-Biennial Oscillation (QBO). This is a regular variation of the winds that blow high above the equator. The QBO is currently in an easterly phase, increasing the chance of cold northerly or easterly winds from the Arctic and continental Europe. The Stratospheric Polar Vortex, has tended

to be weaker than normal so far this winter but its strength has now returned to around average, and its influence is likely to be limited in the immediate future. An active Madden-Julian Oscillation favours westerly winds over the UK during early February but then a reduction in westerly winds during mid and late February.

All these effects are happening on a background of warming UK winters, consistent with wider global warming trends.

Taking the ‘global drivers’ into consideration, our long-range forecast systems suggest February will start off mild, with the chance of cold weather increasing as we go through the month and into March. This means we could yet see some cold weather-related impacts such as snow and ice. This increased chance of cold does not exclude the possibility of milder conditions.

Despite any speculation you may read elsewhere, the science simply does not allow for specific detail on the amount of rain or snow over the coming months or exactly when severe weather may occur. However, long-range forecasts can provide useful information on the likelihood of possible conditions averaged over the whole of the UK.

The science of longer-range and seasonal outlooks is at the cutting edge of meteorology and the Met Office is one of the leaders in scientific research in the area. Even with ‘perfect’ prediction systems, the fundamentally chaotic nature of the atmosphere means these predictions will always be concerned with the likelihood of different kinds of possible weather conditions and the levels of risk of impacts they might bring. Even with ‘perfect’ prediction systems, the fundamentally chaotic nature of the atmosphere means these predictions will always be concerned with the likelihood of different kinds of possible weather conditions and the levels of risk of impacts they might bring.

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Date Created
January 2024

Solar maximum in sight – but when will it be?

Description

Throughout autumn and winter there have been a number of sightings of the Northern Lights, or the aurora borealis, in the UK. As 2024 continues, the question for many space weather experts is when we'll see a peak in the Sun's activity as part of this solar cycle.

The auroras on Earth, which are most commonly seen over high polar latitudes but can often spread south to be visible over parts of the UK, are chiefly influenced by geomagnetic storms which originate from activity on the Sun.

Space weather forecasters, like those who work at the Met Office Space Weather Operations Centre (MOSWOC), spend their time studying the Sun's activity and forecasting the arrival of coronal mass ejections which cause geomagnetic storms, solar flares and solar radiation storms, collectively known as space weather. Space weather typically originates from sunspots on the Sun's surface.

Image: Richard Ellis, Royal Photographic Society

While these events contribute to the magnificent displays of colours in the sky as part of the auroras, the most severe of these events also have the potential to cause radio blackouts, disrupt GPS systems and interact with some ground-based infrastructure on Earth.

Forecasting of specific events is incredibly complex, with satellites looking at features on the Sun including sunspot activity on the Sun's surface from around 93million miles away. However, the Sun has a natural rhythm, called the solar cycle, which drives varying levels of activity, with the next peak due in 2024. This cycle works on around an 11-year cycle from one solar maximum to the next maximum.

Met Office Space Weather Manager Simon Machin explained: "While the solar cycle doesn't help determine specific space weather events, what it does is help our forecasters understand the context of their forecasts.

"In its simplest terms, the solar cycle is linked to the number and intensity of sunspots that are visible on the surface of the Sun. This affects the likelihood of space weather events impacting the Earth."

When will the solar maximum be?

The last solar minimum, when the Sun's activity was at its lowest in the cycle, occurred in December 2019, with the Space Weather Predictions Center (SWPC) now predicting that the solar maximum will occur in 2024.

However, as Simon explains, the passing of solar maximum doesn't mean that further space weather events won't occur.

"One of the curious things about the solar maximum is that it's not possible to declare it has occurred until after it has happened and when you observe that reduction in sunspot activity," said Simon.

"We know that the solar maximum increases the chances of space weather events impacting the Earth, but even as you move away from it as get through 2024 into 2025 and beyond, the Sun will continue to emit solar flares and geomagnetic storms. This means that further auroral displays are likely, as well as an ongoing chance of potentially impactful space weather events, even as we move towards the next solar minimum."

MOSWOC is one of a handful of 24/7 space weather prediction centres around the world, constantly looking for signs that the Sun's activity could impact the Earth. By providing warning of these events reaching the Earth, mitigations can be taken by key industries to avoid some of the most severe impacts from extreme space weather events.

Find out more about the Met Office Space Weather Operations Centre or view the latest Met Office Space Weather forecast.

Date Created
January 2024